U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN No. 225.

Experiment Station Work, XXIX.

Compiled from the Publications of the Agricultural Experiment Stations.

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AMERICAN CAMEMBERT CHEESE.
SWELLING IN CANNED PEAS.

PREPARED IN THE OFFICE OF EXPERIMENT STATIONS.

A. C. TRUE, Director.

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EXPERIMENT STATION WORK.

Edited by W. H. BEAL and the Staff of the Experiment Station Record.

Experiment Station Work is a subseries of brief popular bulletins compiled from the published reports of the agricultural experiment stations and kindred institutions in this and other countries. The chief object of these publications is to disseminate throughout the country information regarding experiments at the different experiment stations, and thus to acquaint farmers in a general way with the progress of agricultural investigation on its practical side. The results herein reported should for the most part be regarded as tentative and suggestive rather than conclusive. Further experiments may modify them, and experience alone can show how far they will be useful in actual practice. The work of the stations must not be depended upon to produce "rules for farming." How to apply the results of experiments to his own conditions will ever remain the problem of the individual farmer.—A. C. TRUE, Director, Office of Experiment Stations.

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EXPERIMENT STATION WORK.[a]

INJURY TO AGRICULTURE BY SMOKE AND GASES.[b]

The more or less widespread belief that the large quantities of smoke and gases which escape into the air in localities where extensive manufacturing operations are carried on are a direct injury to vegetation and may under certain conditions become a menace to animal life has been shown to be well grounded by many carefully conducted investigations in Europe and this country.

W. A. Buckout, of the Pennsylvania Station, studied the extent of injury to the agricultural and forestry interests of Pennsylvania by pollution of the atmosphere in coking and other manufacturing operations, visiting a number of manufacturing centers and noting the conditions of vegetation in their immediate vicinity. The injurious effect of the gases, smoke, and soot was shown in the destruction of forests and orchards in the vicinity of these manufacturing establishments. Analyses of leaves of various kinds collected in the vicinity of coke ovens and chemical works showed that they had absorbed, to their serious injury, large amounts of sulphurous and chlorin fumes.

He concludes, in general, that "smoke which darkens the air and blackens and defiles whatever it touches, and gases conspicuous to the sense of smell, are in several ways a menace to the health and well-being, the comfort, and convenience of the whole surrounding neighborhood."

The means he proposed for preventing or lessening injury from this source are the erection of tall smokestacks or chimneys in order to secure the most effectual aid in rapid dilution of the gases, the location, if possible, of such works in large open plains instead of in ravines or valleys, as is usually the case, and the use of smoke consuming or condensing devices.

Smoke-consuming devices and means for reclaiming wastes should always be employed and their use be required and enforced by law. There is no more

[a] A progress record of experimental inquiries, published without assumption of responsibility by the Department for the correctness of the facts and conclusions reported by the stations.

[b] Compiled from Pennsylvania Sta. Rpt. 1901, p. 297; Utah Sta. Bul. 88; U. S. Dept. Agr., Bureau of Chemistry Bul. 89.

reason why the pollution of the atmosphere should be permitted than the pollution of water or earth. The economics of manufacturing may suggest the need of a more careful and complete combustion of coal or the reclaiming of wastes, but if they do not, then, for the good and well-being of the community at large, the manufacturer should be required to put them in operation. * * * To a degree, attempt is made to regulate these matters by statute, but the provisions are local rather than general, and have not kept pace with the rapid strides made by the manufacturing industries. So far as they have been employed, it has been with reference to city life and surroundings and has had no bearing upon the agricultural interests. There should be a general law upon the subject defining what amounts of smoke and other wastes may be permitted in the air, and prescribing penalties whenever it is found that those amounts are exceeded.

It is a matter of common observation in mining regions that the dense fumes emitted by smelters are particularly injurious to vegetation, and sometimes to animal life, in some localities, as at Butte, Mont., absolutely preventing the growth of vegetation of any kind, and resulting in varying degrees of damage in other localities.

J. A. Widtsoe, of the Utah Station, has reported the results of a careful and detailed study of the nature and extent of damage done to trees, orchards, crops, live stock, and soils by the smoke from copper smelters in or near the towns of Murray and Bingham Junction, some 5 to 7 miles south of Salt Lake City, Utah, as well as of the substances emitted by the smelters.

The most noteworthy substance found in the smelter smoke was sulphur dioxid, which varied from 59 to 93 parts per 10,000 of air, according to the distance from the smelter ($1\frac{1}{4}$ to $\frac{1}{2}$ mile). The smoke also carried considerable quantities of flue dust containing large quantities of iron, some copper, and traces of arsenic. The general conclusions reached as a result of the investigations were that—

When the wind causes the smoke to beat upon a field for a considerable length of time, it tends to injure the crops severely and thus to diminish their yields. It tends to injure animals that are right in the line of the prevailing winds, and therefore are compelled to breathe the smelter smoke in the air. It may occasionally poison pools of standing water, when the washing of rains and melting snows cause a concentration of the flue dust in low-lying places. * * * It does not injure equally all land within any given radius. The injured fields are those in the paths of the prevailing winds. It does not injure the fertility of the soils of the district.

Practical suggestions to farmers as to how to manage lands subject to injury by smelter smoke are made as follows:

(1) Don't irrigate on days when wind blows the smelter smoke toward your farm. The injuries from the smoke are always greatest when the soil is wet.

(2) Animals on pasture are likely to gather more flue dust than if they are barn fed. As far as possible, therefore, grow hay on the affected pastures.

(3) Trees are weakened so much by being robbed of their leaves several times in one or several seasons that death usually follows. It is not advisable

to plant orchards or trees of any kind in the districts affected by the smelter smoke.

(4) Annual crops are generally the safest in smelter districts.

(5) Lucern, which is a perennial, appears to withstand the effect of the smelter smoke very well and is a safe crop for smelter districts.

(6) Windbreaks of any kind, sheltering a farm from the direct action of the smoke, would do much to modify the injuries from smelter smoke.

J. K. Haywood, of the Bureau of Chemistry of this Department, has also studied the injury to vegetation by fumes from a copper smelter situated near Redding, Cal. He found that "the vegetation around the smelter for at least 3½ miles north, 9 miles south, 2½ miles east, and 5 to 6 miles west has been greatly injured. * * * It is the opinion of the author that this injury to vegetation will continue and even increase its limits unless the fumes are condensed. The fumes can be condensed and sulphuric acid formed, for which a ready market would probably be found."

It is thus seen that the unrestrained emission of smoke and fumes from manufacturing establishments is already not only a menace to general health and comfort but also a direct injury to agriculture in many localities, and that the damage is likely to increase rather than diminish as the mining and agricultural interests develop unless restrictive measures are adopted. That there are practical means of reducing injury from this cause is demonstrated by the success of the methods practiced in Germany in connection with coke ovens and furnaces, of which it has been said:

> Nothing is more striking than the quiet and cleanliness which prevail about these establishments. Nothing is wasted; scarcely a fleck of smoke escapes from the ovens or rises from the tall chimneys. The air is clear and undefiled without, and luxuriant crops of grain and vegetables grow up to the very walls of furnaces and coking plants in this country, where every morsel of food is needed and where waste is considered a crime.

INCOMPATIBLES IN FERTILIZER MIXTURES.

In view of the growing interest in the home mixing of fertilizers and the encouragement which the practice has received from the work of the experiment stations,[a] attention should be called to the fact that the indiscriminate mixing of fertilizing materials is not a safe practice. This is due mainly to two facts: (1) When certain materials are mixed chemical changes take place which result in loss of a valuable constituent, as when lime is mixed with guano nitrogen escapes, or in a change of a constituent to a less available form, as when lime is mixed with superphosphates the phosphoric acid is made less soluble; and (2) mixtures of certain materials, as, for example, potash salts and

[a] U. S. Dept. Agr., Farmers' Bul. 222, p. 5.

Thomas slag, are likely to harden or " cake," and thus become difficult to distribute if kept some time after mixing.

A German investigator[a] has suggested the following diagram, which indicates for a few of the more common fertilizing materials the combinations which may be safely made. In this diagram the dark lines unite materials which should never be mixed, the double

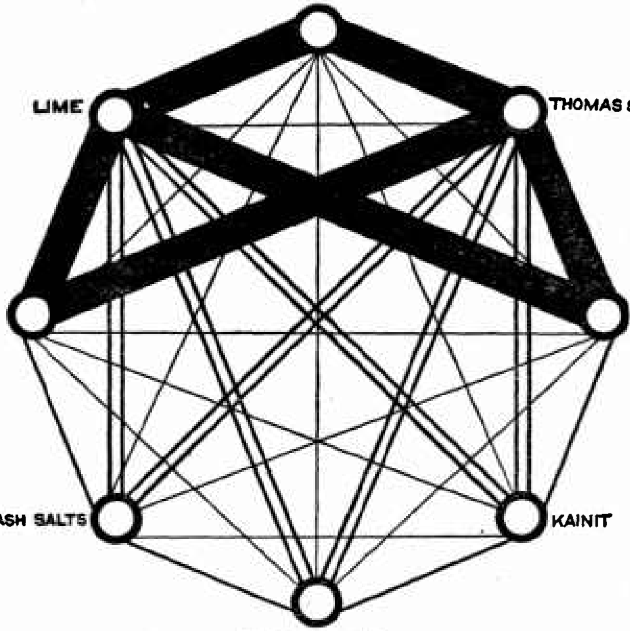

FIG. 1.—Diagram indicating what fertilizing materials may and may not be safely mixed.

lines those which should be applied immediately after mixing, and the single lines those which may be mixed at any time.

VALUE OF FLINT VARIETIES OF CORN.[b]

In a recent bulletin of the Connecticut State Station, Director E. H. Jenkins, writing more especially for New England and the more northerly regions where corn is grown, says:

No more important subject connected with dairy farming can engage the efforts of farmers and of this station than the improvement of our corn crop, both in yield and in quality. Before the silo came in as a necessary part of the dairy equipment and before the feeding value of corn fodder and stover was generally recognized—corn being raised chiefly for the ears—we had in this

[a] Bot. Dept. [Trinidad] Bul. Misc. Inform., 1904, No. 42, p. 61.

[b] Compiled from Connecticut State Sta. Bul. 147.

State many varieties of flint corn, which were perfectly hardy, had been bred with more or less skill for very many years, and yielded shelled corn much richer in protein than we can buy to-day. Corn meal with some bran was the staple feed for cows. With the coming of the silo we have sought after varieties which would give the largest possible yield of "roughage," stalks and leaves, and these appeared to be the southern and western dents. Our smaller flints have been neglected. The cold summer of 1903 was disastrous to the corn crop, and it is believed that many farmers finally lost their crop of seed of these proved but somewhat neglected flint varieties in that year. Are we not in danger of parting with a birthright in letting these flint varieties slip away from us?

While we are seeking to establish some leguminous crop to supply the present lack of protein on the farm, we need also to breed some of these flint varieties, naturally rich in protein, to a still larger production of protein and also of stover.

The classic work of Hopkins and others at the Illinois Station has shown that this is quite possible and has shown how to accomplish it.

Starting with some one of our well-established flint varieties of early maturity, in which it would not be difficult probably now to select ears bearing kernels with 12 to 13 per cent of protein, we may hope to secure an increase of several per cent in the average protein content of our crops of shelled corn.

Such a gain would be of immense advantage to stock feeders and particularly to those who still abide by corn meal as the principal grain feed, along with wheat feed, and look with suspicion on all concentrated "forcing" feeds.

This station has taken up this, together with the other question of increasing the yield of stover, in continuation of the work on the corn crop which it has done in past years.

BUYING AND JUDGING SEED CORN.[a]

The work of the experiment stations on corn breeding, referred to in the previous bulletins of this series,[b] has resulted in great activity in the line of improvement of seed corn both by individual farmers and by seedsmen. It is now widely recognized, as M. F. Miller, of the Missouri Station, states, that "the importance of using seed corn that has been well bred (sometimes spoken of as 'pure bred') is just the same as the use of well-bred animals in breeding live stock. The laws governing the breeding of animals are the same as those governing the breeding of plants, and the arguments in favor of using well-bred animals for breeding purposes apply with equal force to the use of well-bred corn for seed. The terms 'well bred' or 'pure bred' as applied to corn mean much the same as they do in animals—that is, strains or varieties that have been kept pure and selected for a series of years for high production and high quality. The productive power of such corn as compared with that which has received little attention in the matter of selection is very marked, the well-bred

[a] Compiled from Missouri Sta. Circ. of Inform. 19.

[b] U. S. Dept. Agr., Farmers' Buls. 193, p. 20; 210, p. 11.

varieties often yielding from 5 to 40 bushels more per acre under conditions exactly similar."

Many professional corn breeders are engaged in the development of "pedigreed" corn, and it is probable that for several years to come many farmers will get their seed corn from this source. "In such case the corn should always be bought in the ear. The corn which seedsmen or breeders sell in the ear is usually the most select, and that is the kind to buy. Moreover, a man should know exactly the character of the corn he plants. It will always be economy, therefore, unless one knows definitely the kind of ears shelled, to pay the extra price for ear corn. Another thing that farmers should be cautioned against is the buying of corn from men who are not perfectly reliable."

The characteristics which distinguish the most improved types of corn have been fully described in the earlier bulletins of this series above referred to. The points which it is desired to emphasize here are that if the farmer is not prepared to breed his own seed corn he should buy improved corn only from a reliable grower and in the ear, and examine it carefully to see that it is of the type and quality desired.

TOBACCO SEED.[a]

In a recent bulletin of the Connecticut State Station, A. D. Shamel, of the Bureau of Plant Industry of this Department, calls attention to the fact that the most vigorous and productive tobacco plants can be obtained only by using the heaviest seeds.

This is partly because the heavy seed has the most perfect embryo or plantlet in it and the largest supply of available plant food to support the seedling until it has developed roots and leaves so as to feed itself.

One of the causes of freak tobacco plants—that is, such as top out prematurely or differ in shape and quality of leaf from the bulk of the crop—is the sowing of small and light seed. In a series of extensive experiments in the Connecticut Valley, the writer separated samples of seed of the varieties grown in this region into light, medium, and heavy grades. In all cases the small and light seed produced the earliest plants in the seed bed, and these plants when set in the field developed a large percentage of undesirable plants which are almost a total loss to the grower. * * * Heavy seed produces large, healthy, uniform, and well-developed plants. * * *

Many of the light and inferior seeds are of the same size as the heavy and desirable seed, and the difference generally between large and small seed is slight, so that it is not possible to separate the desirable from the undesirable seed by screening with any kind of sieves.

The common method of water separation was found to be thoroughly unsatisfactory.

A seed separator making use of an air current was therefore made and was successfully used. This consisted of a glass tube 1 inch in diameter and 5 feet

[a] Compiled from Connecticut State Sta. Bul. 148.

long, and a glass receptacle for holding the seed, having the diameter of the long glass tube, and so arranged with a finely woven wire screen in the bottom as to hold the seed in the receptacle and at the same time freely admit a current of air directly into the seed. The top of this receptacle is fitted with a coupling into which the long glass tube can be set and held in place. The current of air is generated by a common foot bellows, and regulated with a valve.

The seed to be separated is poured into the receptacle, usually about 1 to 2 ounces at a time, the glass tube set in place, and a current of air pumped into the seed. The lightest seed and the chaff are first blown out of the tube, and next the small seed. Small seeds of the same character as the larger seeds have proportionally more surface than the larger; consequently the small as well as the light seed is removed by this machine. It is believed that machines constructed on this principle will be found satisfactory.

A large number of tobacco growers in Connecticut are this year following Mr. Shamel's advice to separate their seed and grow their tobacco only from the heaviest and best seeds they have.

COWPEA SEED.[a]

A bulletin of the Oklahoma Station calls attention to the fact that cowpea seed always commands a good price, and, in fact, that the price is often so high as to restrict the area planted. This is due to the fact that the peas are difficult and expensive to harvest and store.

The bulletin discusses two methods generally used in harvesting cowpea seed—namely, hand picking and cutting and thrashing the vines. Thorough harvesting by hand requires several pickings at different dates, and as the price of efficient farm labor is usually high this method of harvesting is expensive, it being estimated that hand-picked peas cost from 75 cents to $1 per bushel for harvesting. Waiting until the vines are ripe and cutting and thrashing or flailing results in a considerable saving of labor and expense, but is accompanied by a considerable loss of seed.

The scythe-mower, one of the bean harvesters found on the market, or an improvised cutter may be used in harvesting the peas. Cutting with the scythe is laborious, and the ordinary mower is difficult to operate in heavy and tangled vines and wastes peas by shelling. On the whole, the best way to harvest the cowpea vines appears to be to cut off the plants just below the surface of the ground by means of a bean harvester. Where much cowpea seed is to be raised in the most economical way such a machine is considered indispensable. The small farmer, however, can not afford a bean harvester.

He can use practically the same method by making a knife about 18 inches long with a shank on one end of it about 10 inches long for attaching it to the shank of a cultivator. The knife should be made out of good spring steel, and when it is placed it should slope backward at an angle of a little less than 45° and slightly down at the free end. The blade should be at least 2 inches wide

[a] Compiled from Oklahoma Sta. Press Bul. 112.

and a fourth of an inch thick and reenforced at the heel, as good-sized plants will give it quite a strain. After a little experience in adjusting, the operator will find it a very useful implement for the purpose and quite inexpensive. The advantage in cutting the plants below the ground is that not near as much seed is shattered in cutting. In this, as well as with the other methods, the vines bearing seed should not be run over by horses or implements. If they are in the way, put them to one side with forks. After cowpea vines bearing seed have been cut it is desirable to get them stored or thrashed as soon as possible, as the sun causes the pods to shed the seed. Usually the vines are so green and contain so many green leaves that they can not be put in a stack or mow without some curing in the field. The vines should be put in cocks at once after cutting, and after a day or so curing in the field be put in small loose stacks or in mows, where the beans that shatter out may be saved. Many times half of the seed is allowed to shatter out after the vines have been shocked by leaving them in the field too long. The greater part of the drying and curing should be done in the stack or the mow.

The vines that have ripened seed are not near as sappy and hard to cure as when they are cut early for hay. If the grain is to be flailed out it can be done with more ease if the vines are pretty well dried out. If the grain is wanted for seed it is not practicable to thrash the crop with a common thrasher as the grains crack so readily. Some report that by putting in blank concaves and removing some of the teeth from the cylinder and reducing the speed the work is satisfactory, but our experience, after taking all these precautions, is that too many peas are cracked to make the operation practicable when the peas are selling at the present high prices. Flailing out the seed will be found the best for the average farmer. When the pods are well dried the operation is not expensive or laborious.

Cowpea seed is often greatly damaged in storage by the weevil. Such damage can be prevented by putting the seed in a close covered bin and placing a dish of carbon bisulphid on the top of the seed. The carbon bisulphid evaporates rapidly and the heavy fumes sink into the mass of the seed and destroy the weevils. The operation should be repeated several times during a season if the seed is to be kept free from the weevil.

In small quantities the carbon bisulphid costs 15 to 25 cents per pound. As a rule, 1 pound of the liquid will treat 30 bushels of the seed. The liquid and the gas are very inflammable and poisonous and all fire should be kept away from it. If the weevils are kept out and the seed is stored in a dry place it will retain its vitality two or three years.

TREATING SEED OATS FOR SMUT.[a]

In a recent bulletin of the Indiana Station, J. C. Arthur, who has been making a careful study of the subject for many years, says:

The farmer who raises oats is very likely to sustain a considerable loss of his crop from the presence of smut in the field. Oat smut is a fungus that starts when the seed germinates, grows inside the stalks, using part of the nourishment of the oat plant, thereby preventing the stalks attaining full

[a] Compiled from Indiana Sta. Buls. 87, 103.

height, and winds up its career by turning the grain, and often the chaff, into a black powder, which is made up of the reproducing spores of the fungus. If this black powder gets upon the seed grain sown the following year, the resulting crop will be correspondingly injured by smut.

Oat smut is very common throughout the State and the country at large. Unless preventive measures have been taken, almost any field will show from a few per cent to 10, 15, 25, or even 50 per cent of smut. Any amount under 10 per cent attracts little or no attention, because the affected stalks are, for the most part, so much shorter and less conspicuous than the healthy ones, due to the dwarfing action of the fungus. * * * If any farmer doubts that he is losing from 1 to 10 bushels or more of oats out of every hundred that he harvests, let him go into his field and count every stalk, little and big, to the extent of 500 or 1,000 in different parts of the field, making note of the number of those blasted with smut, and he will be surprised at the result. He should not be deceived into thinking that some of the stalks are too small to be worth counting, for if it had not been for the attack of smut they would have been as large as the others and borne full-sized heads of good oats.

W. A. Henry, of the Wisconsin Station, estimates the loss from oat smut in Wisconsin alone at from $3,000,000 to $7,000,000 annually, according to the season and other conditions. The great value of an efficient practical method of prevention of smut is obvious.

The formalin method of treatment "has proved remarkably efficient, cheap, and easy of application, and comes as near to being an absolutely satisfactory process as any known for a fungus disease." This method, as Professor Arthur describes it, is as follows:

Sprinkle the seed oats with a solution of formalin of the strength of 1 pound of formalin to 50 gallons of water until nearly moist enough to pack in the hand. Shovel into a pile, and cover. After two hours or more the oats are ready to sow, or can be spread out and dried and kept for future sowing.

Formalin is a gas dissolved in water, and the reason for covering the oats is to keep it confined and give time for the gas to penetrate between the chaff of the grain, and thus reach every spore of the fungus and kill it. After the spores are killed it is immaterial whether the grain is sown at once or dried and sown after a time. If sown without drying, a little more per acre should be used to allow for swelling.

The efficiency of this method has been fully tested and is beyond question. Its cost is about 1½ cents per bushel, or less, for the material. Formalin can be bought at almost any drug store. The time and labor required are not great, and the returns are ample.

An application of this method of treatment, which promises great practical usefulness in the grain-growing regions, is in the treatment of seed oats on a large scale in the elevators. A great deal of seed oats is bought directly from the elevators, and Professor Arthur's experiments at a local elevator show that oats may be rapidly, efficiently, and cheaply treated for smut in the elevator.

All the handling of the grain being done by machinery made it possible to apply the formalin treatment most expeditiously at the rate of 500 bushels per

hour. Formalin was used of the strength of 1 pound in 25 gallons of water, and about 100 gallons of the solution used for each 500 bushels of grain. The cost of the formalin for this amount of grain is therefore from $1.20 to $1.60, according to the retail market price at the place of purchase, or about one-third of a cent per bushel.

To carry out treatment in this manner it is necessary to have a vertical drop or chimney about 3 feet square and 40 to 50 feet high. On the inside of this drop are placed shelves or deflectors sloping downward, alternately on two opposite sides from top to bottom. As the grain drops from the top it is tossed from side to side as it strikes against the deflectors in its fall, and is thus thoroughly mixed. By means of a small steam pump the solution of formalin is thrown against the falling grain, near the top of the drop, in a fine spray. The rate at which the grain is allowed to flow determines the amount of solution applied per bushel. By the time the grain reaches the bottom it has been so agitated that the moisture is distributed with perfect uniformity.

The grain is allowed to remain in the bin at the bottom of the drop, or run into another bin, as may be most convenient, and after standing not less than two hours, or over night if desired, it can be taken to the field for sowing, or can be run again through the drop and this time dried out by a blast of cold air. After drying, the oats may be kept indefinitely or shipped. Oats thus treated are not injured for feeding, but if properly handled are even improved by killing deleterious germs other than smut spores. * * *

There are already a number of grain elevators in Indiana fitted with machinery for this work. Some of them will treat seed oats in this manner for any farmer without additional charge, and the expense in any case will amount to little more than the time of going to the elevator, while the profit to the farmer may be considerable.

POTATO CULTURE.[a]

As a result of a large number of experiments, F. W. Rane, of the New Hampshire Station, gives the following concise directions regarding the culture of potatoes in New England:

Soil and location.—The ideal potato soil is deep, friable, retentive of moisture, and well drained. Heavy clay and very light sandy soils should be avoided. Stony land renders planting and cultivating difficult and expensive. The presence of decaying organic matter in the soil not only furnishes valuable plant food, but also increases its water-holding capacity. Everything else being equal, a northern slope would be preferred to a southern one, except when grown for early use, as the crop is sometimes badly injured by the intense heat, increased by a southern exposure during a hot, dry season.

Manure.—Fresh stable manure, especially when harrowed in, tends to produce such diseases as scab, blight, and rot, and should therefore be applied, if possible, to the crop preceding, and enough used to provide for the needs of both crops.

The potato thrives best in a cool, moist soil, and, unlike the corn crop, roots quite deeply. It is therefore recommended that stable manure be plowed in for the above-mentioned reasons, and also to prevent the germination of the weed seeds contained in it, thus greatly reducing the cost of hand cultivation.

When a crop is to be grown on freshly broken sod, the best results will gen-

[a] Compiled from New Hampshire Sta. Bul. 111.

erally be obtained by plowing in a light application of stable manure, and using in the drill 8 to 10 hundredweight per acre of a good high-grade fertilizer.[a]

Chemical fertilizers.—In large potato-producing sections where the supply of stable manure is limited many growers are obtaining splendid results from the exclusive use of chemical fertilizers, using about 1,500 pounds per acre. Where the physical condition of the soil is poor we should recommend plowing under a crop of clover, peas, or other legumes, and the application of 12 to 15 hundredweight per acre of a high-grade fertilizer. In using either stable or chemical manures an excess should be avoided, as it tends to produce an overgrowth of vines, which excludes the air and sunlight, thus favoring the conditions which invite and spread the attacks of the blight.

One hundred bushels of potatoes contain about 12.6 pounds nitrogen, 4.5 pounds phosphoric acid, and 30 pounds potash.

The knowledge of the analysis of the crop is of little value to the grower until he has studied his soil and learned its needs; but, knowing both, he will be able to apply at the lowest cost the proper amount of plant food required to produce a full crop.

Preparing the ground.—The time for plowing will depend largely upon the nature and situation of the field. If infected with quack grass or located upon a slope that is liable to wash, spring plowing would be preferred. If plowed in the fall, an extra amount of harrowing will be necessary in order to obtain the same results as produced by spring plowing. Whatever the time selected for plowing, the soil should be harrowed and pulverized in a thorough manner, not being content with stirring and leveling the surface only, but using such harrows as will work deep and leave the soil in the best condition to receive the crop.

Seed.—Good seed is one of the essentials to success in growing this crop. As the potato decreases in vitality when grown from poor stock, it is best to either select carefully our own seed by saving the product of such hills as yield the greatest weight of smooth, marketable tubers, or buy from a reliable grower whom we know to be selecting his seed in a like manner.

It is a false idea of economy to save a few dollars per acre by using cheap seed, and thereby ruin your chances of success at the start. The fact that many growers are planting small and indifferent seed year after year largely accounts for the low average yield reported, and also for the deterioration of most varieties after eight or ten years in the hands of the average grower.

Small to medium tubers grown from seed selected as already mentioned, that have not lost their vitality by sprouting, will generally produce a more satisfactory crop than larger seed of the same variety grown from a poor strain of tubers that have been weakened by excessive sprouting.

Varieties.—As our New England markets demand a round or oblong white potato, we recommend for main crop the planting of such varieties as the Green Mountain and Delaware, or varieties that closely resemble them.

As seedsmen are each year introducing and selling at fabulous prices new and untried varieties, the most of which are soon dropped from their catalogues and forgotten, we advise growers to depend on standard sorts that have been fully tested and found adapted to their soil and market, and allow their experiment station to test the novelties for them, thus preventing a large annual waste of time and money.

Planting.—The time for planting will depend upon the soil, locality, and sea-

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[a] Containing 3 per cent of nitrogen in nitrate of soda and sulphate of ammonia, 6 per cent phosphoric acid in dissolved boneblack, and 10 per cent of potash in muriate or sulphate of potash.

son. If wanted for early use, the seed should be planted in April, while for main crop the work may be done between the 1st and 20th of May.

Improved planters are rapidly coming into general use among the large growers, and while their cost prohibits their ownership by the average farmer, the purchase of one is generally recommended in cases where 6 or more acres are annually planted. Unless great care is taken in cutting the seed to have the pieces uniform in size and shape, and good judgment exercised in operating the machine to secure an even distribution of the seed and fertilizer, also straight rows and proper covering, the advantage of the planter will be lost. The depth for covering should depend upon the nature and condition of the land; in low or clayey soils 3 inches will be sufficient, while upon light, well-drained land a covering of 4 inches is advisable.

The distance for planting should be governed by the fertility of the soil and the variety used, as well as by the number of eyes on each piece of seed. A good rule for most conditions is to use seed cut to two or three strong eyes and plant every 15 to 18 inches in rows 3 feet apart.

Cultivation.—This is a very important operation, and must be attended to at the proper time if the crop is to be kept clean and thrifty at a minimum cost. The neglect of a few days in one cultivation may mean the difference between profit and loss. Cultivation should begin by stirring the soil with a weeder or smoothing harrow within one week from time of planting, and the operation repeated every week or ten days as long as the size of plants will admit, the objects sought being to prevent crusting of the surface soil and the extermination of weeds before they have gained foothold in the soil.

The horse cultivator will next be of service in cultivating the crop, and should be run quite deep for the first cultivation, after which all operations should be shallow, as deep cultivation after the plants have become well established causes untold injury to the roots feeding in the top soil.

The amount of hand hoeing necessary will depend upon the thoroughness of the above operations and the amount of grass and weed seeds in the soil. If the weeding and cultivating has been faithfully done, the only necessary hand work should be in the removal of the scattering weeds along the row.

Diseases.—The principal diseases are the early and late blight and scab.

The early blight usually appears from the middle to the latter part of July, during hot, dry weather, and causes a premature dropping of the foliage, but is unattended by rot.

The late blight usually appears in August and spreads very rapidly during warm, moist weather. Its attacks are sudden and destructive, and are usually accompanied by rotting of the tubers.

The above diseases may be prevented by thoroughly spraying with Bordeaux mixture. The first spraying application should be made when the vines are 8 to 12 inches high, which with the late varieties will be about July 15. The number and frequency of later sprayings will depend largely upon the weather. Usually four to five times will be sufficient, unless washed off by heavy rains, the object being to keep the vines covered with the mixture at all times after the first spraying. To destroy the potato beetle, one-fourth to one-half pound of Paris green should be added to each 50 gallons of mixture. To prevent the scab, avoid contaminated land and seed, also excess of fresh stable manure. Seed that is affected, and smooth tubers that have been selected from affected stock, should be treated with formalin or corrosive sublimate solutions before planting.[a]

[a] U. S. Dept. Agr., Farmers' Bul. 91.

FURTHER POINTS IN TOMATO GROWING.[a]

The Ohio Station has recently published in bulletin form the results of a number of years' work at that station in the forcing of tomatoes. The station reports that while tomatoes are profitably forced in midwinter near large cities in the East, the practice has gained but little headway in Ohio. The prices received are not sufficiently high to make it profitable. In growing early spring and summer crops under glass there has usually been good profit. The tomatoes grown at the station have been marketed for the most part in small cities near the station and in Cleveland.

The most noteworthy fact in this connection is that while these markets have been well supplied with southern tomatoes, the prices received for greenhouse tomatoes have been considerably above and often double those quoted for the southern product. This is because of the superiority of well-ripened greenhouse tomatoes over those shipped in a green state from the South. There is a steady demand, even in small cities, for the home product at prices which are remunerative. At the season when tomatoes can be grown in the greenhouse to best advantage they are more profitable than either lettuce or cucumbers during the same period. The crop is one well deserving the attention of those engaged in vegetable forcing.

In recent experiments at the station the early yields with both Stone and Beauty varieties were much in favor of plants set 1 foot apart each way and trained to a single stem. The total yield also of the Stone variety was greatest when the plants were thus spaced, and nearly as good results were secured with the Beauty variety. The general conclusion was that in planting 2 feet apart each way, as has been the usual custom at the station, the plants have not been crowded so closely as they might have been to secure the highest yield per square foot. Early yield, which seemed to be favored by close planting in this experiment, is of especial importance because of the increased price received for the early product.

A large number of experiment stations, including Maine, Virginia, New York, and New Jersey, have also reported the results of pruning tomatoes to one or more stems and uniformly recommend the single-stem training. On this point the New York State Station reports as follows:

Single-stem training is clearly superior to three-stem training for forcing tomatoes in winter in this climate. The superiority in seen in the larger yield of early ripening fruit and in the larger total yield. There is but slight difference in the average size of fruit produced under the two methods of training, but on the whole the fruit of the single-stem plants seems to be slightly the larger.

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[a] Compiled from Ohio Sta. Bul. 153; New York State Sta. Bul. 125. For an earlier account of tomato culture see U. S. Dept. Agr., Farmers' Bul. 186, p. 12.

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Another point reported upon by the Ohio Station is the matter of subirrigation of tomatoes in the greenhouse. The subirrigated tomatoes gave considerably larger yields than surface-watered tomatoes. The average size of the fruits of the subirrigated tomatoes was also larger and the amount of rot per square foot very much less than in the case of the surface-watered plants. On this subject the station states that—

In our experiments we have found that by repeated watering on the surface the soil, unless more porous than the average greenhouse compost, becomes packed, and as a result, unless considerable care is exercised in watering, the lower portion of the bed will often become quite dry, even though the upper surface be thoroughly soaked. This not only results in a check to the growth of the plants, but if it occurs after the fruit has become well developed it will often cause a considerable loss from dry rot. On the other hand, when the water is allowed to rise by capillary attraction, as is the case when subirrigation is practiced, the soil is kept open and porous and in good condition for the free access of air and acts as a sponge in taking up and holding a large amount of water. Subirrigation not only gives the best growth of plants and highest yield, but it also serves as a check to the disease known as dry or tip rot.

In this connection the value of a mulch with subirrigation is pointed out. A grower, near Wooster, is reported to control the moisture of his tomato beds by subirrigation and the use of a mulch. The best results have been secured by mulching as soon as the tomatoes are planted in the bed. The surface of the mulch is allowed to become dry and remain in that condition for some time.

If the mulch is kept wet on the surface from the start the presence of the moisture seems to bring about conditions which promote disease. Toward the close of the season he surface-waters the mulch and thus washes some of the fertility out of the manure into the soil, where it is available for the crop when it is most needed. Where the water supply is scanty, mulch should be used, whatever method of watering is employed, and it will be found beneficial in all cases. * * * Mulching with strawy manure accomplishes the same results as subirrigation. It is more beneficial, however, with surface watering than with subwatering.

INFLUENCE OF FEED ON MILK.[a]

The extent to which the composition of milk, especially its fat content, can be influenced by the food of the cow has been the subject of much discussion and difference of opinion. H. H. Wing and J. A. Foord, of the New York Cornell Station, discussing this question, say:

For a long time the opinion has been very strong in the minds of dairymen that the percentage of fat in milk is directly and largely influenced by the food of the cow. If ninety-nine out of a hundred dairymen are asked whether they can make their cows give richer milk by changing the food, they will answer at once in the affirmative, and many will go so far as to say that they have done it time and again. Still, this is one of the results that careful investigators

[a] Compiled from New York Cornell Sta. Bul. 222.

have been trying to secure for the last twenty years, and so far they have met with little or no success.

While a summing up of all the work on this subject heretofore done in this country and abroad would indicate that, in general terms, "it is not possible materially and permanently to increase or diminish the percentage of fat in the milk of a cow through changes in the amount or character of the food," it was thought that these results were not conclusive, because the experiments were, as a rule, made with cows which had previously been well fed and cared for.

The author therefore undertook to determine what would be the effect on the milk of high feeding of cows which had previously been insufficiently nourished. The experiments were made with 10 cows from a single farm herd of 21 cows of mixed breeding, only 4 of which were over eight years of age, thin in flesh at the beginning. At the height of the lactation periods the cows were given all they would readily consume (averaging 8 to 12 pounds daily) of a grain ration made up largely of cotton-seed meal, wheat bran, gluten feed, buckwheat middlings, and old-process linseed meal, with occasionally ground oats and corn meal. The proportions and combinations of the different feeds varied at different periods. The improved ration contained about twice as much digestible protein as the cows had formerly been receiving.

The results show that "in a herd of poorly fed cows an abundant ration, easily digestible and rather nitrogenous in character, and continued through two years, resulted in an average increase of one-fourth of 1 per cent of fat in the milk (or a percentage increase of about 6 per cent). This was accompanied by an increase of about 50 per cent in total amount of milk and fat produced. The increased production was secured economically so far as the food cost of milk and fat is concerned."

The improvement of the general condition of the cows receiving the richer rations was very rapid and very marked.

PROTECTING COWS FROM FLIES.[a]

Of the various remedies suggested for relieving cows of the annoyance from flies, some have proved more or less efficient. In considering the use of such remedies it seems desirable, therefore, to determine what effect, if any, flies have on milk production. Several stations have published data which bear on this point.

In 1899, W. L. Carlyle, of the Wisconsin Station, reported an ex-

[a] Compiled from Connecticut Storrs Sta. Bul. 32; Massachusetts Sta. Rpt. 1902, p. 61; Oregon Sta. Rpt. 1903, p. 29; Wisconsin Sta. Rpt. 1899, p. 92.

periment in which seven cows were practically protected from flies during the daytime by confinement in a comfortable stable provided with screen doors and windows, and several other cows, confined in a small lot abundantly supplied with shade trees, were constantly on the move fighting flies. Both lots were pastured at night, received the same kind and amount of grain feed, and also all the freshly cut sorghum and green corn that they would eat readily. The cows confined in the stable ate more of the green corn and sorghum, but lost more in live weight during the four weeks of the experiment than the cows left out of doors. During the first two weeks of the experiment the cows in the stable produced 56.7 pounds of milk less than during the two weeks previous, while the cows not confined decreased only 40.4 pounds. The corresponding decrease in the production of fat was 0.81 pound for the stabled cows and 2.16 for the cows not stabled.

This experiment can not be accepted as in any way conclusive, and yet it would seem to indicate that while the cows in the stable increased slightly more in the percentage of butter fat in their milk than did the lot in the paddock, yet they ate more of the feed and fell off more in the amount of milk given, though they decreased much less in total fat production. It is easily seen, however, that the increase in the total amount of butter fat given in the one lot over the other in this experiment was not sufficiently great to pay for the increased trouble and expense entailed in the stabling of the cows during the greater part of every day.

In an experiment at the Oregon Station a proprietary remedy for repelling flies was applied to four cows from July 25 to September 30. These cows gained 265 pounds in weight during the period of treatment, while four cows kept under similar conditions, but not treated, gained only 212 pounds. Two of the treated cows showed a shrinkage of 12.6 per cent in milk production during August and September as compared with their yields during the two months preceding this period. Two other cows not treated showed a corresponding shrinkage of 22.4 per cent. While the results indicate some advantage from the use of the fly repellant, the data reported are not sufficient to warrant a definite conclusion from the standpoint of economy.

In 1902–3 C. L. Beach and A. B. Clark conducted experiments on this subject which have been published very recently in a bulletin of the Connecticut Storrs Station. The station herd was divided into two similar groups, one of which was treated daily with a proprietary remedy for repelling flies during the first, third, and fifth weeks of the experiment in 1902, and the other lot during the second and fourth weeks of the same period. In all other respects the two lots received the same treatment. The experiment was repeated in 1903 on the same plan, except that the periods were increased to two weeks and the records of only the second week of each period were used in order that

the possibility of the effects of the treatment extending from one period into the next might be avoided. It is stated that the remedy the second year was efficient as a fly repellant. On several occasions the milk had a peculiar odor, which was attributed to the remedy. No appreciable gain either in the production of milk or butter fat was considered due to the use of the fly repellant in the experiments. The conclusions, as stated by the authors, are as follows: "(1) The annoyance of cows by flies seems to be overestimated, and (2) certain proprietary ointments, known as 'fly removers,' will protect the animal to a greater or less extent, but their use has little or no effect on the milk or butter-fat secretion."

It would rather seem, therefore, that no great claim can be made for such remedies on the ground of economy of milk production. However, the results of experiments with such proprietary remedies do not warrant sweeping conclusions as to the general question of the advisability of protecting farm animals from annoyance by flies. Under more extreme conditions of annoyance the benefits of efficient protection would probably be more marked, and it is obvious that in many cases such protection is demanded from humanitarian considerations, if for no other reason.

RECENT EXPERIMENTS WITH TURKEYS.[a]

Although turkey raising is an important branch of the poultry industry, little experimental work has been carried on with this class of poultry at the agricultural experiment stations as compared with the amount of work which has been done with chickens and ducks. For many years the Rhode Island Experiment Station has studied the breeds and breeding of turkeys, the development of the turkey industry, and the characteristics and treatment of turkey diseases. This work, which has furnished results of great interest and value, is being continued.

As is well known, turkeys retain many of the characteristics of their wild state. They roam extensively, gathering much of their own food, and unless prevented will make their nests in out of the way places, where they are free from interference. In some regions, particularly the southern United States, it is a custom to gather the turkey eggs and hatch them under hens, as they may be thus cared for more successfully than otherwise. The young chicks are delicate, and if hatched by a turkey they are apt to roam with the mother while yet too young, and the percentage of loss will be very high. If the turkey is allowed to sit, there are other difficulties to be met, as

[a] Compiled from Ann. Rpts. Live Stock Assocs. Ontario, 1902, p. 107; Canada Expt. Farms Rpt. 1897, p. 331; Minnesota Sta. Bul. 91; Rhode Island Sta. Rpt. 1904, pt. 2, p. 174; South Carolina Sta. Bul. 74.

the nests are often some distance from home, and it is not easy to look after the hen when she has commenced to sit nor can the young be readily attended to when hatched. Believing that a considerable saving would be effected if turkeys could be confined during the laying season without an injurious effect upon the production and fertility of eggs, O. M. Watson, of the South Carolina Experiment Station, studied the problem with Bronze and White Holland turkeys, two hens and a male bird of each variety being used. The two lots were confined in runs 80 by 100 feet long, and were given a variety of feed—in the morning a mash composed of equal parts of wheat bran and corn meal and on alternate nights whole corn and wheat. At all times they had access to oyster shells, and were fed ground bone and meat scrap twice a week. Two nests a yard square were provided in each run. They were covered at the top to keep out rain, and were partly hidden behind brush. Both breeds began laying late in March, the Bronze producing 42 eggs and the White Holland 36. On the tenth day examination showed that 38 of the Bronze turkey eggs and 27 of the White Holland were fertile. The number of eggs hatched with each lot was 27 and 16, respectively. "During incubation 4 eggs were broken by the Bronze hens and 6 were broken by the White Holland, all of which were fertile. The eggs that did not hatch were those laid during the first two weeks."

As will be seen, it was possible in this test to induce the turkeys to lay in the nests which were provided for them, and a fairly large percentage of the eggs laid proved fertile.

Data collected by the Ontario Department of Agriculture from a number of successful poultry raisers furnishes additional information on this point. One of the turkey raisers quoted states that if barrels or boxes are placed in secluded spots around the farm buildings, with some straw for nests and a nest egg, the turkey hens will very seldom wander to the woods, especially if the nests are made in good season. Another writer states that when nests are prepared in the orchard with brush and old boards, in such a way that they resemble a brush heap, the turkeys are very apt to lay in them. It was also noted that young birds lay earlier than the older birds. If turkeys are well fed in the spring they will begin laying before the fence corners and rubbish heaps, which they prefer for nests, are free from snow, and under such circumstances they are more likely to make their nests about farm buildings.

According to a recent English agricultural journal,[a] a large tub or barrel laid on one side may be satisfactorily used for a turkey nest. A round nest should be shaped from damp soil, well beaten down, with a little slaked lime shaken over the inside, which makes it firm.

[a] Mark Lane Express Agr. Jour., 92 (1905), No. 3839, p. 545.

The nest should be lined with fine hay. A large nest from 20 to 24 inches square should always be provided, as otherwise the tail feathers become injured and do not get straight again before the birds molt. The article quoted recommends corn, barley, and dry rice as the best grains for turkeys while sitting and emphasizes the importance of proper feeding at this time.

The data collected by the Ontario Department of Agriculture offer some information regarding turkey management and fattening. A liberal use of insect powder about the nests and on the old birds and young chicks is recognized as an important measure. In general, the turkey raisers quoted agree on the importance of strong, healthy breeding stock, the need of confining the young turkeys for two or three weeks after hatching, protection from dampness, and the feeding at first with soft feed, which, however, should not be sloppy.

As regards the young birds, one feeder recommends for the first week stale bread soaked in milk and pressed quite dry, and after this such feeds as hard-boiled egg yolks with stale bread crumbs. Occasionally a little black pepper may be used, and the young birds should be fed every two or three hours. Sour milk curds, with finely cut onion tops and dandelions, are also recommended, the green feed being regarded as especially desirable. When two or three weeks old, the young turkeys can be fed grain, and, of course, should always be supplied with fresh water, grit, and the necessary green feed. As they grow older they are allowed to roam, and when they have access to stubble fields, and grasshoppers are abundant, they will need little feed except what they can gather until it is time to fatten them for the Thanksgiving or holiday trade. For fattening, a favorite grain mixture is corn, oats, and wheat. One of the writers quoted suggests finely chopped buckwheat, oats, and barley 1:2:1, a little commercial poultry food rich in protein being added, and the whole moistened with milk. The hulls should be removed from the finely chopped grain by sifting.

In a discussion of the essential features of poultry raising under local conditions, recently published by the Minnesota Agricultural Experiment Station, C. E. Greene makes some statements regarding turkeys which are based on personal experience.

The young chicks are allowed to roam at will and are fed occasionally some corn cake. For fattening, barley and corn soaked or boiled for a short time, are considered good feeds. "If the turkeys are kept in a slightly darkened room and fed heavily for about three weeks the quality of the flesh will be very much improved, and they will generally pay for the feed in extra weight." For the winter feeding of breeding stock whole corn, wheat, or barley, with grit and water, are recommended. "Twice a day is often enough to feed them.

They do not need a warm place in which to roost. They will do better in a rather cool house with plenty of fresh air."

"The high prices paid for turkeys in November and December and the ease with which they may be raised should stimulate a greater interest in turkeys among farmers who can give them a good range."

A test carried on in Ireland of different methods of fattening turkeys was recently reported by H. de Courcy.[a] Thirty young cockerels of similar breed, which had ranged on stubble fields for about three weeks and had received some grain during the latter part of this time, were divided into three uniform lots, the individual turkeys weighing on an average about 17 pounds each. The feeding period covered three weeks, and during the first ten days all the turkeys were fed in the morning a mash of equal parts of boiled potatoes, boiled turnips, barley meal, maize meal, and ground oats with one-half as much linseed meal, the grain being wet up with skim milk to a rather stiff mash. Milk and water in separate vessels were also supplied, as well as mixed charcoal and grit. The turkeys were fed in a yard, and after an hour for feeding and exercise were turned into a rather dark poultry house, where they remained until evening, when they were again driven to the yards and fed crushed corn, oats, and barley. During the latter part of the test this method of feeding was continued with one of the lots, with the result that the average gain per bird during the entire feeding period was 2 pounds 12 ounces. Of the remaining two lots one was fed twice a day by hand cramming a stiff mash of equal parts of ground barley, corn, and oats with a small amount of melted fat, linseed meal, and skim milk, the mixture being rolled into pellets about 2 inches long and 0.75 inch in diameter. The average gain for the entire period was 3 pounds 6 ounces per bird. The remaining lot was fed with a cramming machine a similar mixture wet up with skim milk to form a slop of about the consistency of cream. Owing to their size and strength, it is stated that at first some difficulty was experienced in feeding the turkeys, but this was soon overcome by placing the birds one at a time on a low stand, which raised them off the ground so that the head was on a level with the nozzle of the cramming machine and in such a position that they could be fed conveniently. "After a day or two the turkeys grew accustomed to this manner of feeding, and when meal times came they showed much eagerness to mount the stand and receive their share of food." With this lot the average gain was 4 pounds 4 ounces per bird. As will be noted, the greatest gain was with the turkeys fed the soft mash with a cramming machine. The cost of feed ranged from 34 cents per head with the turkeys fed without cramming to 41 cents with those fed with a cramming machine.

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[a] Jour. Bd. Agr. [London], 11 (1904), Nos. 7, p. 385; 8, p. 495.

At the Manitoba Experiment Station S. A. Bedford a few years ago studied the gains made by turkeys confined in pens as compared with those allowed their freedom. The birds in pens were given all they would eat clean of a mixture of wheat, oats, and barley 2:1:1. In the morning the grain was fed chopped and wet with milk, but in the evening it was fed whole. It was noted that the turkeys were apparently more fond of oats than of the other grains, so toward the end of the fattening period the proportion of this grain was increased. A little grain was fed the turkeys which were not confined in addition to the food which they could gather. The five turkeys in pens weighed on an average 6.55 pounds each at the beginning of the test. During the forty-two days of the feeding period the average gain was 4.05 pounds, 6 pounds of grain being eaten per pound of gain. The turkeys running at large also weighed at the beginning of the test 6.55 pounds each and made an average gain of 1.85 pounds. In both cases the greatest gains were made during the first three weeks of the period. It is stated that the penned turkeys when dressed shrank 5 per cent less than those running at large and that they were plumper and were in every way more inviting in appearance.

In a recently published statement by G. M. McKeown [a] regarding turkeys and turkey management at the Wagga Experimental Farm, New South Wales, attention is directed to the importance of bronze blood in improving common stock. "The pure [bronze] gobblers * * * are remarkably prepotent and will rapidly improve the quality of any flock into which they are introduced. The appearance of the young stock is greatly improved, they mature earlier, and the weight, quality, and flavor of the flesh are strongly influenced for the better by the introduction of bronze blood. * * * For some years many gobblers have been bred which at about eight months have weighed, alive, 23 to 25 pounds, while some at nine months have reached 28 to 31 pounds. Pullets have been bred to weigh 16 pounds at eight months, and gobblers which have been sold from the farm have been reported by their buyers as weighing 39 and 40 pounds before they were two years old."

An important feature of the turkey industry is dressing to suit the demands of the market sought. This point was recognized and discussed at length in connection with the Irish tests cited above and is a matter which has been considered in connection with the Canada Department of Agriculture work. A summary of data on this topic based on work of the Canada Department of Agriculture has appeared in an earlier number of this series.[b]

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[a] Agr. Gaz. New South Wales, 15 (1904), p. 1166.

[b] U. S. Dept. Agr., Farmers' Bul. 144.

GRIT AND MINERAL MATTER FOR CHICKENS.[a]

That chickens require a certain amount of coarse mineral matter or grit in order that they may properly grind and assimilate their food is well understood, but that it is also highly important that their food should be amply provided with mineral nutrients, such as lime, phosphoric acid, etc., to build tissue, bone, and eggs (especially shells) is not so generally realized and given consideration in poultry feeding.

W. P. Wheeler, of the New York State Station, who has been studying this subject for a number of years,[b] has reported a series of experiments which were made to ascertain what deficiencies in this respect may occur in ordinary poultry foods and how they may be corrected.

It is estimated that about 10 per cent of the daily growth of a chicken is made up of inorganic (mineral) matter. The grains which ordinarily supply the larger part of the food of chickens are comparatively low in mineral (ash) constituents, and will not furnish a sufficient amount of mineral matter for the bodily requirements of the fowl. Where chickens have free range on a farm they will probably get sufficient mineral matter themselves, but where they are fed in confinement and mainly on grains the supply of mineral matter at once becomes important. The experiments of the station have shown that the great benefit which chickens derive from the addition of animal food to their feed is due mainly to the large amount of mineral matter which the animal food ordinarily contains.

In experiments made with 19 lots of from 24 to 76 Leghorn chicks, each fed from ten to twelve weeks, beginning with chicks from one to three weeks old, the rations for some lots were made up without animal food and for others with animal food. The materials were so combined that certain rations were lower than usual in ash, others higher, and still others of medium ash content. To the rations thus made up there were also added varying percentages of glass sand, of fine ground Florida rock phosphate, of ground oyster shell, of bone ash, of sand and Florida rock, of sand and oyster shell, or of bone ash and oyster shell.

In various tests from one twenty-fourth to three twenty-eighths as much sand (grit) was used as of other dry matter fed, and from one forty-eighth to three twenty-eighths as much of the mineral as of the other dry matter. In some rations in which these two classes were combined the added ash elements weighed one-eighth as much as the other dry matter of the rations and the average amount was about one-tenth.

The results show that sand, both in a ration without animal food and in one containing animal food with bone, contributed to a more efficient use of the food.

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[a] Compiled from New York State Sta. Bul. 242.

[b] U. S. Dept. Agr., Farmers' Buls. 97, p. 16; 186, p. 23.

The increase in weight was not much greater, but the chicks were healthier, more vigorous, and apparently better prepared than those without sand in their food to make profitable later growth. This was true even in cases where the chicks were running upon sanded floors and so were free to pick up sand as they required it.

This emphasizes the importance of supplying an abundance of grit in the food.

The ground Florida rock phosphate proved of more value as an addition to rations than did sand. When used without sand in two grain rations better results followed, in both efficient use of food and in rate of growth, than when sand alone was added to similar rations. When used with sand in one ration containing animal food but somewhat low in ash and in another ration without animal food, the chicks grew more rapidly and required less food for equal growth than when sand only was mixed with the same foods.

Oyster shells were much less efficient than either sand or ground rock phosphate and did not prove a desirable component of the rations.

In general the results of the experiments emphasize the importance of a plentiful supply of ash for growing fowls.

[They] indicate that even the tiny chicks can make profitable use of such uncommon elements of poultry diet as sand and rock phosphate. The tests must not, however, be regarded as revolutionizing poultry feeding or considered as recommendations for the use of all such materials in ordinary practice. They are, rather, of scientific interest as establishing the necessity for certain elements in the food of poultry. Those elements can be obtained easier, in better combination, and in more palatable form in materials already recommended by our most successful feeders—fine raw or cooked bone. Of these, of some animal meal, of green vegetables, clover or alfalfa, and of good, clean grit, every grower of young chicks should make careful and constant use.

A SUCCESSFUL BROODER HOUSE.[a]

In recent publications of the Connecticut Storrs Station F. H. Stoneburn gives a description of a successful brooder house built at the agricultural college during the fall of 1903, and discusses the importance of properly constructed houses for this purpose and the principles on which they should be constructed.

The importance of properly constructed brooder houses is emphasized by the fact that under modern conditions "everyone engaged in commercial poultry keeping desires to produce a large proportion of his annual crop of chickens at some time of the year other than the natural breeding season of his fowls."

The production of any large amount of this out-of-season stock by natural methods of rearing is, of course, out of the question, and the incubator and the brooder must be relied upon largely. * * *

A brooder building designed for the rearing of chicks during the cold months should embody several distinct features. For the health and well-being of the chicks it should be so constructed that the temperature and ventilation can

[a] Compiled from Connecticut Storrs Sta. Bul. 33; Rpt. 1904, p. 172.

be absolutely controlled, plenty of sunshine admitted, and enemies of all kinds kept out. For the comfort of the attendant and the economical conduct of the business it should be convenient in every way.

While in the brooder house built at the college it was necessary to make special provisions for purposes of instruction and experimental work which would not be necessary or desirable in a house constructed for practical purposes only, it is believed that the plans and methods of construction followed will be suggestive and helpful to the practical poultry raiser.

The house as built is 15 by 30 feet in size, with a 4 by 5 foot extension on the east end. This latter is used as an entry or "anteroom," permitting students and others to pass in and out of the house at will during bad weather without exposing the chicks to drafts. An alleyway 4 feet in width extends along the entire north side, and the rest of the floor space is divided into pens. These are six in number and are 5 by 11 feet in size.

An examination of the accompanying cuts will show that the vital feature of

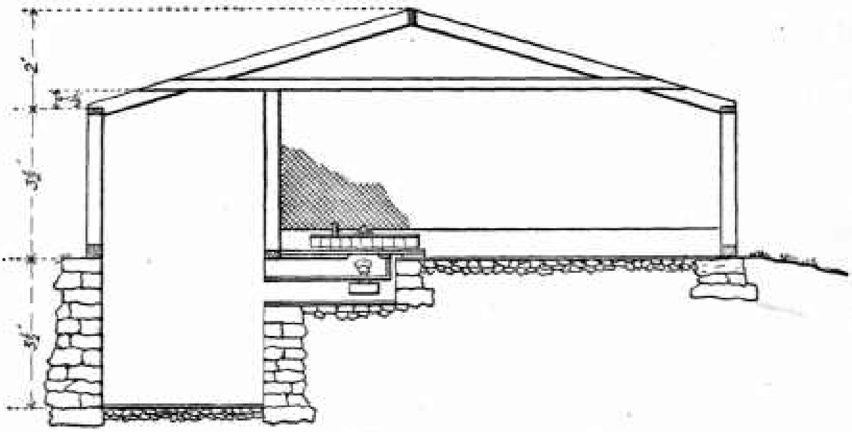

FIG. 2.—Cross section of brooder house.

the building is the elevated chick floor, or rather the depressed alley floor, the latter being 3½ feet below the former. (Fig. 2.) This arrangement secures several advantages. It enables the attendant to care for the brooders and feed the chicks without the constant stooping required where the brooders are operated upon the floor in the usual manner. Further, it reduces the inclosed air space by fully one-third, effecting a corresponding saving in the amount of heat required to maintain a given temperature. It also places the chicks nearer the ceiling—the warmest part of the room—thus giving them the benefit of all the available warmth. Repeated tests in the house under discussion demonstrated that in cold weather the temperature at the level of the alley floor is 14° lower than at the chick floor, but 3½ feet above. And, finally, the amount of side wall exposed to the weather is reduced nearly one-half, quite a consideration in wind-swept positions. The disadvantage of the plan becomes evident only when it is found necessary to enter the pens for any purpose. It is inconvenient because of the necessary climb to enter the pen and the confined space in which to do the work. But it has been found unnecessary to get into the pens except on rare occasions, so this is not a serious drawback.

The site selected for this house is a knoll sloping slightly to the north and abruptly to the east. The alley was formed by digging a trench of the required depth along the north side of the site of the proposed structure. Parallel stone walls 4 feet apart were then laid in this trench and carried to a height of 3½ feet. These were joined by a wall of the same height at the west end, the east end being reserved as a doorway. When laying the wall on the south side of the alley, provision was made for three lamp pits, each 2½ by 5 feet and 1 foot in depth, as indicated upon the plans. Each pit accommodates the heaters of two brooders. (Figs. 3 and 4.)

The rest of the foundation is a simple wall varying in height according to the slope of the land, but carried to the same level as the alley walls. Finally the entire floor was cemented, including the bottoms of the lamp pits, the cement in the chick pens being at the level of the top of the foundation walls.

Because of the small size of the building the frame is constructed entirely of 2 by 4 inch material, except the sills, which are 4 by 4 inch. The walls are 3½ feet in height. The roof is an even span, with a rise of 2 feet. The rafters are tied with collar beams which are spiked on level 7½ feet from the alley

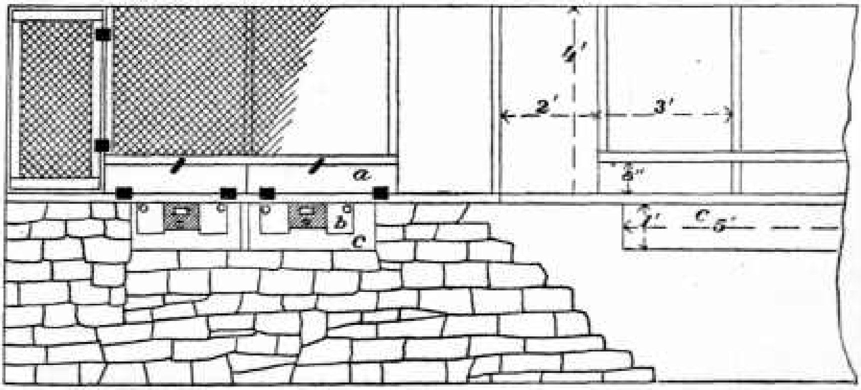

FIG. 3.—Section of brooder house showing south side of alley: *a*, clean-out door rear of brooder; *b*, heater; *c*, lamp pit.

floor. The entire frame is covered with seven-eighth inch matched boards, with one-ply Flintkote upon the roof and Swan's extra heavy felt upon the sides. This gives an absolutely wind-proof structure. Eave troughs are required to carry from the roof the water which might otherwise make its way into the building.

The interior is lathed and plastered with fireproof asbestic plaster. By carrying the plaster across on the collar beams an attic is formed which is of great value in controlling the temperature, preventing direct radiation through the roof. A large sliding ventilator opens into this attic through the ceiling above each pair of chick pens, and in each gable doors are placed, opening into the attic from outside. These are regulated according to the weather. This forms a decidedly effective ventilating system, which is entirely under control.

In the south side of the building are six windows, one for each pen, each a single sash with six panes of 10 by 12 inch glass. These windows are hinged at the bottom and swing inward, being controlled from the alley by cords. At the west end of the alley another window of the same size is placed. This lights the alley thoroughly, which is very desirable, particularly on dark winter days. Chick doors are 6 by 7 inches in size, and are also operated by cords. (Figs. 5 and 6.) The construction of pen partitions is so fully illustrated by

the cuts that no further explanation seems necessary. The door is made nearly as wide as the alley, to permit the easy passage of wheelbarrows for cleaning.

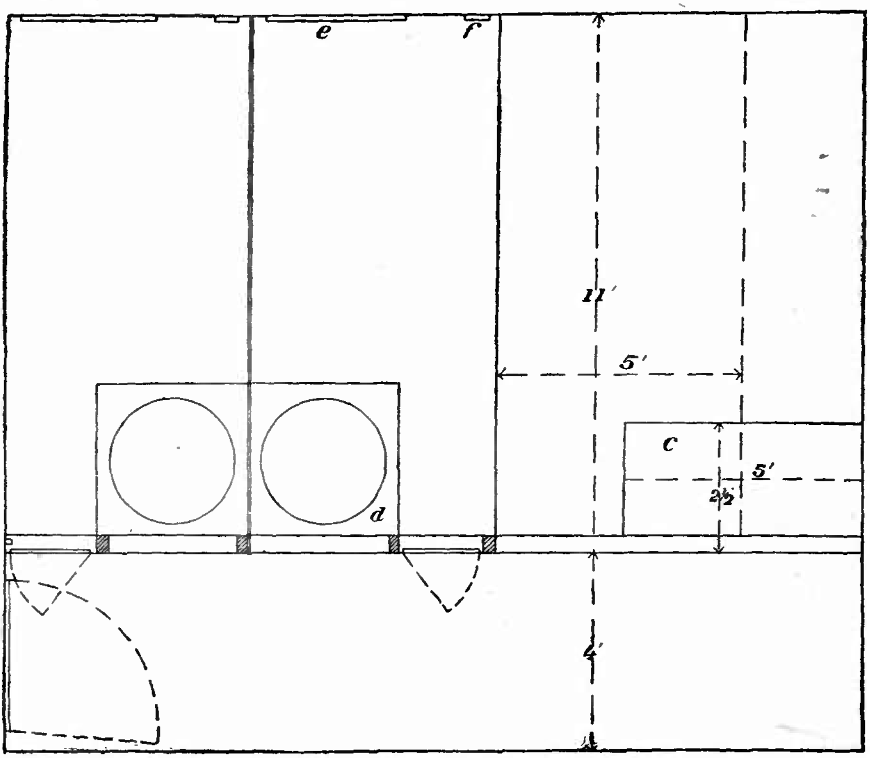

FIG. 4.—Plan of brooder house: *c*, lamp pit; *d*, brooder; *e*, window; *f*, chick door.

The brooders were constructed by the college carpenter, using the metal parts of Peep o' Day brooders. They consist simply of the heaters and hovers mounted upon platforms, no sides or top being required. Because the heaters

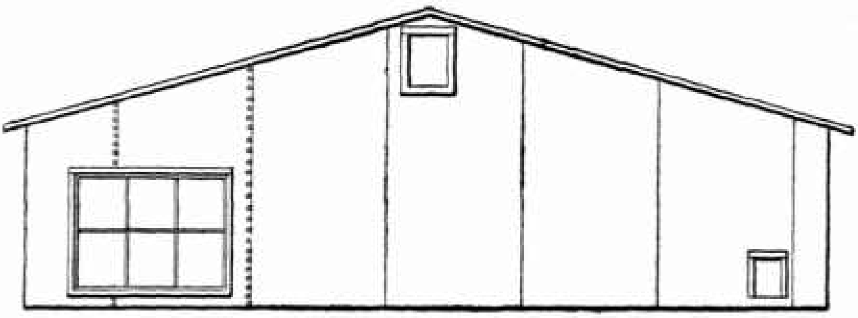

FIG. 5.—West elevation of brooder house.

are suspended in the lamp pits, the floors of the brooders are elevated but 2 inches above the floors of the pens, which enables the chicks to enter the hovers without climbing the usual bridge. The pen floors are kept covered with 1 inch of sand and more or less fine litter, such as chaff, cut straw, etc.

In ordinary weather the six lamps maintain the temperature sufficiently high, but an auxiliary heater is supplied for use in extreme cold. This is a stove placed near the west end of the alley, and a small fire in it will keep the building sufficiently warm at any time.

For the needs of the practical farmer or poultry man some slight changes might be made in the above plan. The alley could be reduced to 3 feet in width, and still be large enough to accommodate one attendant. The length of the chick pens might be reduced 1 or 2 feet, thus making the building narrower. The depth of the alley might be made 3 feet instead of 3½ feet, and the sides made of heavy plank instead of masonry. The cement floor could be replaced with an earth floor, provided rats could be repelled. The entry ex-

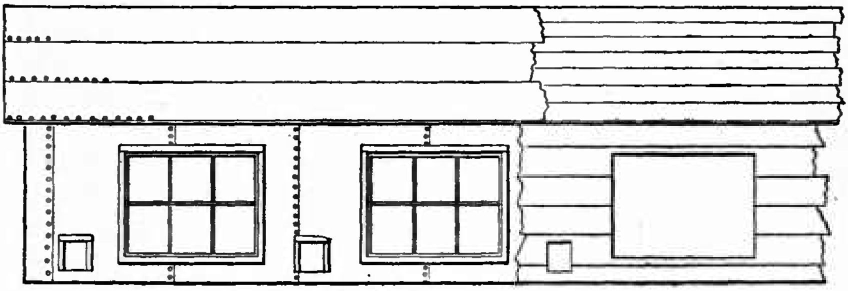

FIG. 6.—South elevation of brooder house.

tension could be dispensed with. For ordinary use in southern New England the wall might be satisfactory if constructed of two thicknesses of inch boards with paper between. All of the above changes would result in a financial saving so far as the first cost of the building is concerned, but, excepting the reduction in width of alley, they would also cause a decreased efficiency.

CAMEMBERT CHEESE MAKING IN THE UNITED STATES.[a]

Of the many highly prized types of European cheese only a very few have been made with any great degree of success in this country. This is particularly true of the soft cheeses, the importation of many of which is made difficult by the brief period in which they remain in a marketable condition.

With a view to developing a new industry in the United States the Connecticut Storrs Station and the Dairy Division of the Bureau of Animal Industry of this Department have been studying in cooperation the manufacture of Camembert cheese, a type of soft cheese considered well adapted to home manufacture.

As regards the distinction between the hard and soft types of cheese it may be said that in making the hard cheeses, of which Cheddar, Swiss, and Edam are well-known types, the curdled mass is cut into small pieces to allow much of the whey to separate from the curd and is often heated to further this separation. High pressure is then employed to force out more of the whey. The resulting curd ripens

[a] Compiled from Connecticut Storrs Sta. Bul. 35.

slowly and is not ready for market for some months. In making the soft cheeses, of which Camembert, Brie, Limburger, and Neufchatel are examples, the curdled mass is allowed to drain naturally and is not subjected to heat or pressure. Soft cheeses, therefore, contain a large amount of water, ripen in a few weeks, developing strong flavors and odors, and remain in good condition only a very short time.

In the investigations which have been carried on in Connecticut it is reported that soft cheese of the Camembert type has been made which has been pronounced by experts to be identical with the best imported cheeses. In undertaking this work no serviceable description of the manufacture of Camembert cheese as practiced in Europe was found available, the process evidently being held as a trade secret. The effort was therefore made to discover the principles involved and then to develop practical methods.

So far only a preliminary report has been made and this deals mainly with the agents concerned in the ripening process. It is believed that the first change affecting ripening is the souring of the curd by lactic-acid bacteria, following which the curd is softened and the flavor developed by two species of mold.

Inasmuch as cheese of the Camembert type can be made by using pure cultures of these organisms, it is considered possible to control the ripening to such an extent as to produce a much more uniform product than has been done. The manufacture of first-class Camembert cheese in America is believed to be perfectly practicable. The method of manufacture is to be described in a later bulletin. Meanwhile it is to be borne in mind that these investigations are still incomplete, and that further work will be required in confirming the results so far obtained and in applying them in practice before this industry can be considered as securely established.

PREVENTION OF SWELLING IN CANNED PEAS.[a]

H. A. Harding and J. F. Nicholson, of the New York State Station at Geneva, report experiments carried on in a local cannery which had suffered serious loss from "swelling," due to a very resistant form of bacteria, which show that heating 2-pound cans to 240° F. for thirty minutes will destroy this germ, "the most resistant so far known in pea canning," and prevent "swelling" without affecting the quality of the goods enough to hurt their sale.

Like results obtained by the Wisconsin Station have been noted in an earlier bulletin of this series.[b]

[a] Compiled from New York State Sta. Bul. 249.

[b] U. S. Dept. Agr., Farmers' Bul. 73, p. 28.

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